

Upgrading in Asian clusters: Rethinking the importance of interactive-learning

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Abstract

This paper is concerned with unpacking the role of the cluster supporting the SMEs move from competing on low-costs to innovating in the global value chain. By comparing 4 clusters in different industries in Asia, we highlight significant *differences* in the learning paths of the clustered SMEs. The paper contributes to current discussion on upgrading in clusters in developing countries by a) providing an explanation on how localized interactive learning and thus clustering relates to upgrading b) discussing under which conditions upgrading requires interactive learning and c) identifying the linkages between particular types of interactive learning and different upgrading strategies.

Key words: Clusters, upgrading, interactive learning, Asia, Indonesia, Thailand, India and Taiwan.

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1. Introduction

Recently development studies have witnessed a surge of interest in clustering of industrial activities as means for supporting upgrading and thus generating economic growth in developing countries (Bell and Albu 1999; Cassiolato et al. 2003; Giuliani et al. 2005; Humphrey and Schmitz 2002; Caniels and Romeijn, 2003; Schmitz 2000 and 2004).

As opposed to the traditional view of clusters as self-contained systems and the almost exclusive focus on local interactive learning, this new strand of literature links local cluster theories with global value chain theories (Loebis and Schmitz 2005). In other words, it links the local sources of knowledge with external sources of knowledge - especially TNCs - to explain upgrading and the access to global markets of certain clusters in developing countries (Archibugi and Pietrobelli, 2003; Giuliani and Bell 2005, Giuliani et al, 2005a and b; Humphrey, 2004; Humphrey and Schmitz, 2002; Pietrobelli and Rabellotti 2004 and 2005;). Clusters are considered to support SMEs upgrading in global value chains to the extent that they facilitate interactive learning both with local and external sources of knowledge (Beccatini, 1990; Marshall 1936; Piore and Sabel, 1984; Schmitz, 1999; Storper 1997). In this context upgrading is defined as the capacity of a firm to innovate and increase the value added of its products and processes (Humphrey and Schmitz, 2002). Furthermore, as industries differ in their knowledge bases and learning mechanisms (Malerba and Orsenigo 2003) the relationship between different forms of interaction and upgrading and innovation varies across industries (Giuliani et al, 2005a; Pietrobelli and Rabellotti, forthcoming).

This paper attempts to contribute to this stream of literature by systematically analyze *what* the elements underpinning interactive learning in the cluster are and which

particular *type* of interactive learning that is especially relevant for upgrading and innovation in specific clusters and industries.

This paper aims at addressing these questions by unpacking the role of the cluster and the importance of specific types of interactive learning for upgrading. In this sense we engage in the recent and open discussion in World Development on upgrading in clusters in developing countries (for example Giuliani et al, 2005a) by a) providing an explanation on how localized interactive learning and thus clustering relates to upgrading and innovation b) challenging existing assumptions in the literature by discussing under which conditions upgrading requires interactive learning and c) identifying the linkages between particular types of interactive learning and different upgrading/innovation strategies.

This is done by opening the black box of localized interactive learning and decomposing it into two basic components: human capital and social capital. We investigate the role of human capital, social capital and thus interactive learning in 4 clusters in Asia, thus extending the geographical coverage of recent studies focusing on Latin America (Giuliani et al 2005a and b).

The reminder of the paper is structured as follows. In the next section we introduce the theoretical framework; taking into account the localized nature of SMEs economic activity in general and specifically the supposed importance of localized interactive learning. Our level of analysis is the cluster. We provide a general introduction to the concept of clusters and discuss the role of clusters as facilitators of interactive learning emphasizing the importance of human capital and social capital in that learning process. Then we turn to the empirical section where special attention is paid to the importance of localized interactive learning takes place in the four cases: the Jepara furniture cluster, the Taiwanese flower cluster, the automotive clusters in Thailand and the Bangalore software

cluster. Finally, we turn to drawing general conclusions on innovation policies to support learning and thus upgrading and innovation in different clusters of SMEs.

2. Clusters and development

2.1. On the concept of cluster and its use in developing countries

This section introduces the concept of cluster and the particularities of developing countries. The concept of cluster has been used with different connotations in the literature (Martin and Sunley, 2003) to refer to both industrial agglomerations or industrial systems (OECD 1999, 2001; Porter 1998,) and to regionally bounded economic activity or regional system (Asheim and Gertler, 2004 and 2005; Maskell, 2001; Maskell and Malmberg, 1999)ⁱ. In this paper we define cluster as geographical concentration of companies in similar or related economic activities and their supporting knowledge organisations (Porter, 2001).

The relevance of clustering to enhance SMEs upgrading has received increasing attention over recent years both among academics, consultants and policy makers. The success in the nineties of the so-called third Italy (Piore and Sabel, 1984; Beccatini, 1990), Baden Württemberg (Stabel, 1996), Silicon Valley (Saxenian, 1994; Cohen and Fields 1998) and Hollywood (Scott 2004) turned their attention towards conceptualizing clusters as engines for stimulating upgrading among clustered SMEs (UNIDO 2001)ⁱⁱ.

The success of clusters in the developed world diffused rapidly to developing countries (Albu 1997; Bair and Gereffi, 2001; Bell and Albu, 1999; Bitran 2004, Giuliani, 2004; Giuliani and Bell, 2005; Nadvi and Schmitz, 1999; Intarakumnerd and Vang, 2006; Pietrobelli and Rabellotti, 2004 and forthcoming; Rabellotti, 1999; Schmitz, 1995 and 1999) while international organizations such as United Nations (UNIDO), the InterAmerican Development Bank and the OECD adopted the cluster approach for

analytical and intervention purposes (OECD, 1999 and 2001; UNIDO 1997, 2001 and 2004).

Generally speaking, clusters in developing countries differ from those of the developed world - and certainly from the most well-functioning clusters in the developed countries - at least in the following aspects: their dynamics (exogenous- versus endogenous based interactive learning), their organizational set up (strong presence of TNCs), their geographical distribution (often satellite clusters; peripheral to the core where most of the interactive learning takes place) and their position in the global value chain (low end activities) which reduces the incentives for TNCs to engage in interactive learning with the SMEs.

In the developing world, the upgrading and learning dynamics of the cluster are strongly shaped by the presence of transnational corporations (TNCs) including international buyers who influence the scope of interactive learning (Vang and Asheim, 2006).

Attending to the geographical distribution, most clusters in developing countries can be conceptualised as so-called Satellite clusters i.e. clusters of SMEs agglomerating in sub-national areas with firms involved in similar and related industrial activities and dominated by transnational corporations (Markusen, 1994). Often they are simply agglomerations of firms within the same industry without localised interactive learning (UNIDO, 2001) or ‘casual’ agglomerations with occasional horizontal linkages, limited cooperation and weak local institutions (Guerrieri and Pietrobelli, 2006) which, in turn, may imply weak localised interactive learning.

Finally, clusters in developing countries usually serve the low end of the global value chain, that is, they are usually specialized in activities at the bottom of the value

chain responding to their low competence level, and hence the possibilities to benefit from interactive learning with the final customer or the TNCs are often limited.

2.2 Clusters and upgrading

The focus of this paper is on how cluster can facilitate interactive learning and thus the move from being a dependent subcontractor competing on low-costs towards becoming an innovator in the global value chain competing on the basis of the provision of knowledge. In other words, we are concerned with the move from the “low road” to competitiveness typical of small firms in developing countries (Kaplinsky 2000; Kaplinsky et al., 2002) to the “high road”, that is, with upgrading (Giuliani et al., 2005b; Humphrey and Schmitz, 2000; Kaplinsky and Readman, 2001; Pietrobelli and Rabellotti, 2004). Upgrading is defined as the ability of the firm to make better products, make them more efficiently or move to more skilled activities in the value chain (Pietrobelli and Rabellotti, forthcoming). In this sense, upgrading is linked to the innovative capacity of the firm. Humphrey and Schmitz (2000) distinguish between four types of upgrading: a) *Process upgrading*: introducing changes in the organization of production. I.e. producing the same goods or services but more efficiently; b) *Product upgrading*: introducing changes in the end product. Product upgrading can be of radical or incremental nature. It can also be new to the firm, the market or the world; c) *Functional upgrading*: acquiring new or superior functions in the value chain. That is, move up to activities of higher added value and d) *intersectoral upgrading*: diversifying to a different sector based on competences acquiring in a specific activity.

As any innovative process, upgrading requires the acquisition of new competences and resources or the recombination of existing ones in new ways. It is considered the result of an interactive process, when firms upgrade as a result of the

continuous interaction with other organisations in the system of innovation (Archibugi and Lundvall, 2001; Edquist, 1997; von Hippel 1988; Lundvall et al. 1992; Loasby, 2000 and 2001). Interactive learning is defined in this paper as acquiring knowledge and competences through collaboration with other organizations. Interactive learning is especially relevant for SMEs and developing countries, where the amount of resources available is very limited and they are required to engage in interactive learning with all available sources of knowledge if they wish to upgrade and access international markets.

2.3. Clusters as facilitators of interactive learning in developing countries

Clusters might facilitate interactive learning and the acquisition of competences required for upgrading. Proximity might ease the interaction with other firms and organizations and enhance interactive learning, and this is particularly relevant for SMEs (Chaminade and Vang, forthcoming 2006). SMEs are more dependent on tacit knowledge and less capable of searching for and using codified knowledge than TNCs – and large firms in general - which forces them to rely more on personal and localised ways of transferring (tacit) knowledge and on learning-by-doing and interacting (Kaufman and Tödtling, 2002).

Two elements seem to be underpinning the capacity of firms engaged in interactive learning with local and external sources of knowledge: human capital and social capital. The extent to which SMEs can learn through the interaction with their environment is a function of their competences, their abilities to interact, their motivation and the opportunities to interact.

Human capital (and knowledge provision) is central in development studies (Kaplinski, 2005; Romer, 1990) and, certainly, in innovation studies. It refers to the ‘skills, education, health, and training of individuals’ (Becker, 1998, p. 1). It has long

been argued that one of the most important constraints preventing developing countries from upgrading is the poor supply of qualified general and subsequently industry specific human capitalⁱⁱⁱ.

Human capital is central to build the absorptive capacity of the firm (Cohen and Levinthal, 1990; Giuliani and Bell 2005) being the ability to utilise available information and knowledge that comes from interaction with other organisations, such as other firms, users or knowledge providers (i.e. research institutions). Absorptive capacity allows SMEs to take advantage of knowledge and information through collaboration, to process it and to commercialize it. Firms need to have the necessary human capital to identify, acquire and transform the knowledge required for innovation and to engage in interactive learning.

SMEs in developing countries usually have limited management skills, thus only limited absorptive capacity. This, in turn, might significantly reduce their chances to engage in interactive learning and since there are limited incentives only for other firms to engage in collaborate with these SMEs (Giuliani and Bell, 2005). Phrased differently, the lack of human capital may exclude SMEs from participating in interactive learning with other firms. This suggests that general human capital building and training targeting particular industry needs (not yet developed in the particular cluster) is needed to support interactive learning. In a systemic perspective this however is only a needed but not sufficient condition for interactive learning^{iv}.

Social capital can be translated to the glue that underpins interactive learning. Following the World Bank “Social capital refers to the institutions, relationships, and norms that shape the quality and quantity of a society's social interactions... Social capital is not just the sum of the institutions which underpin a society – it is the glue that holds them together” (World Bank 1998; 8)^v.

Unless there is a high degree of social capital cooperation, communication and thus interactive learning is limited (Andersson et al 2004; Lundvall, 2005; Nooteboom, 2000). The absence of social capital in turn reduces the local firms' prospects of getting access to important knowledge, knowledge sharing and interactive learning and hence from successfully entering upgrading strategies. As social capital is often highly localized (Putman, 1993) so is interactive learning. Thus social capital is assumed to be important to explain interactive learning in clusters of SMEs. But social capital without the sufficient level or diversity of human capital makes investment in social capital irrelevant (that is, firms would have the opportunity to share, but nothing relevant to share at all). In other words social capital is a necessary condition for interactive learning but not a sufficient one.

In sum, we might expect that human capital without social capital as well as social capital without human capital significantly reduces the possibilities for interactive learning and thus for upgrading and generating innovation. Hence, in a systemic perspective the development of complementary human and social capital are important dimensions for fostering interactive learning and upgrading. When clusters have good human capital and good social capital they facilitate interactive learning and hence upgrading. The extent to which this hypothesis is true will be discussed in the cases.

2.4. Clusters, interactive learning and industrial differences

Although we expect human capital and social capital to be important for interactive learning and upgrading in all industries, we expect the morphology of the interactive learning to differ by industry and institutional setting. As several authors have documented the strategies and types of knowledge generation and the knowledge bases are contingent to the industry (Asheim, et al. 2003; Asheim and Gertler 2004; Breschi,

Malerba and Orsenigo, 2000; Dunning 1977 and 1988, Laursen and Salter 2004; Malerba and Orsenigo, 1993; Pavitt 1984, Tunzelmann and Acha 2004). We may expect to find industry specific differences in importance of interactive learning for upgrading as well as in the dominant form of interactive learning -from the interaction between the SMEs and the TNC, in-between SMEs, between SMEs and knowledge providers or between the SME and the final customer.

To generate adequate policy lessons that systematically take into account the importance of specificities and contingencies of clustered SMEs in developing countries there is a need to analyse under which conditions particular types of interactive learning constitute an important dimension of upgrading strategies and which measures are needed to enhance specific interactive learning in an industrial cluster.

In this sense, in the reminder of the paper, we investigate the extent to which clusters in Asia may facilitate particular types of interactive learning while taking industrial (and institutional) differences into account.

3. Interactive learning and upgrading in a selection of clusters in Asia

Following Giuliani et al. (2005a) we propose four categories of clustered SMEs representing the majority of industries in developing countries: traditional manufacturing, resource-based industries, complex product systems and specialized suppliers. Previous studies (Chaminade and Vang, forthcoming 2006; Giuliani, 2005; Pietrobelli and Rabellotti, forthcoming) have documented that this typology is useful for systematically identifying different patterns of innovative behavior in clustered SMEs^{vi}.

In this paper we will analyse the Jepara furniture cluster as an example of a traditional industry in Asia. The flower industry in Taiwan will be used to illustrate the cluster dynamics and innovation strategies of a natural resource-based industry. The Thai automotive industry will be used to exemplify a Complex Product System (CoPS) cluster

while the Bangalore IT cluster will reveal the innovation patterns of a specialized supplier. A comparison of the 4 clusters is included in Table 2.

The cases are based on a combination of semi-structured interviews with local experts and secondary sources such as publications and reports. According to the purpose of this study, the criteria for selecting the case studies was the following: (1) *Spatial concentration*: all cases display some degree of geographical concentration/clustering of SMEs (2) *Upgrading*: the clusters have recently undergone an upgrading process or have the potential for upgrading (3) *Value chains*: all clusters are inserted in global value chain (4) *Availability of data*: all clusters were extensively documented, specially with regard to human capital and social capital, the two underpinning factors of interactive learning. (5) *Representation*: clusters represent the four categories of clusters mostly dominant in developing countries.

The empirical analysis is influenced by certain limitations in the data sources, especially concerning the availability of updated data and our interpretation of the secondary sources. However, biases have been minimized by triangulating different independent data sources. The novelty of the paper as compared to the existing literature is to analyse the cases in a novel way, combining multiple sources of information. We focus on interactive learning (and on human capital and social capital as its basic components) and link it to the upgrading strategy of the local firms and their insertion in global markets. By doing so, we provide some insight to the question of *how* clustering affects upgrading through interactive learning, thus opening a promising line of research. This partly offsets the data limitation.

3.1. Traditional manufacturing – The Jepara furniture cluster (Java, Indonesia)

Indonesia has a very long tradition of clustering of SMEs around similar activities. Craft industries are usually geographically concentrated, emulating ancient guilds (Tambunan, 2005; Burger et al, 2001). This is also the case of the furniture cluster in Jepara. The Jepara furniture cluster in Java, Indonesia is a large growing cluster. Between 1997 and 2002 the number of firms in the clusters and the number of employees have doubled. In 2002 the cluster comprised approximately 3700 firms, mostly SMEs employing over 58.000 permanent workers (Loebis and Schmitz, 2005). About 70 % of the cluster production is exported while the rest is sold on the domestic markets. Domestic firms account for 75% of the exports while foreign firms are only responsible for 25 % (Berry et al., 2002).

Since the mid eighties the cluster has been dominated by large international buyers (IKEA, for example) who “translate” the demands of the final international customer to the local producers (Kaplinski and Memedovic, 2003) and dominate the higher value activities (Posthuma, 2003; Kaplinsky and Readman, 2002). The indigenous SMEs have followed two types of upgrading strategies to access the global market (Loebis and Schmitz, 2005): i) reduce costs (low salaries, illegal raw materials, avoid taxes) i.e. low road to competitiveness or ii) compete by introducing incremental innovations in processes and products. i.e. high road to competitiveness (see Figure 1). We will focus in this last form of upgrading.

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Upgrading and interactive learning: Only a small proportion of the firms located in this cluster have opted for the second upgrading strategy, that is, product and process upgrading (Loebis and Schmitz, 2005). The role of the international buyer is crucial to understand this type of strategy (Posthuma, 2003). Two modes of interactive learning

seem to be crucial to explain upgrading in some firms in the cluster: The first one is the learning taking place between the international buyer and the principal subcontractor in the cluster (usually a medium size local firm). The international buyer provides the local subcontractors with innovative designs and large orders. It also encourages the local firm to introduce quality standards in the products as well as in the process. For example by demanding that the raw materials used for the products are certified (Loebis and Schmitz, 2005). On the other hand, the principal subcontractor in the cluster usually is linked to a network of suppliers (of final products or raw material) that have also to comply with the quality standards of the international buyer. Loebis and Schmitz (2005) documented that these intermediate firms engage also in interactive learning with this suppliers, improving their quality and the timely delivery.

Role of human capital and social capital supporting interactive learning and upgrading: Firms that have opted to compete by introducing incremental innovations in products and processes have also introduced new managerial and organizational changes, including the compliance with international quality and environmental standards (Loebis and Schmitz, 2005, Perri et al, 2005). But the majority of firms do not have the required human capital to engage in interactive learning. Only a small amount of firms in the cluster have the technical and organizational competences to engage in interactive learning and take the “high road” for competitiveness. Competence building and is basically through apprenticeship and learning by doing in general (Berry et al. 2001). Most SMEs are family based and following patriarchal traditions, the father of the family is usually the owner and manager. Typically his qualifications are limited to technical knowledge about furniture crafting (domain knowledge); managerial and marketing skills are often lacking, which seriously limits the upgrading potential of the firm. There are a

limited number of very skilled craftsmen, who are employed by joint ventures of SMEs or larger foreign firms (Sandee et al., 1998).

Firms that have opted to compete by introducing incremental innovations in products and processes have also introduced new managerial and organizational changes, including the compliance with international quality and environmental standards (Loebis and Schmitz, 2005). These, in turn, have facilitated their access to privileged information and knowledge from the international buyer. That is, learning has taken place through the interaction with the international buyer who has “translated” the demands of the final customers in terms of quality and design to the local firms (Posthuma, 2003) and encouraged the subcontractor to upgrade in processes and products to comply with the demands of the international market.

These subcontractors are also linked to a large network of local suppliers through very strong social capital. Often members of the same large family own different SMEs in the cluster. They participate in networks that share workers, equipment and market channels (Burger et al, 2001). Interactive learning between these horizontal networks of enterprises is usually limited due to the low competence level of the firms involved in the network. But the link of the network with the large firm or trader that acts as a broker between the group of SMEs and the large international buyer might facilitate the acquisition of new knowledge that can be rapidly spread to other firms in the network.

Only firms that have highly developed human capital and organizational competences can adopt this upgrading strategy and get involve in interactive learning with the international buyer. Social capital, on the other hand, provides the platform to disseminate the knowledge acquired from the international buyer within other firms in the cluster.

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3.2. Natural resource-based - The Floral industry in Taiwan

As a *de jure* province of China and taking into account their limited territory, Taiwan can be considered to be in itself a region with complete *de facto* political autonomy from mainland China^{vii}. Taiwan floral industry has experienced a fast growth over the last decade due to a strong domestic market and the increases in cut flower exports, especially to Japan and the US (Tsai, 2001).

The Taiwanese floral cluster is clearly dominated by SMEs. Growers are small in size (usually the average farm size per family is one hectare) due to the high cost of the land. Producer SMEs tend to cluster geographically to be able to access to machinery and greenhouse facilities shared by different producers (Tsai, 2001).

There are other main local actors in the cluster: the biotech labs, the marketing coops and the government. The distribution of flowers to the domestic and international markets is through cooperatives and cooperative marketing teams who also set the quality standards that the farmers should follow (Hsieh, 2001). The marketing channel is dominated by four wholesale companies that use an auction system providing on-line real time information on the market. Government and biotech labs have only very recently emerged as relevant actors in the cluster.

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Upgrading strategy: In contrast to the Jepara furniture cluster, the upgrading strategy of this cluster is clearly driven by local actors and not by TNCs. The Government has recently implemented a plan that aims at upgrading Taiwanese flower clusters by linking them to bio-tech facilities (Hsieh, 2001; Rodrik, 2004)^{viii}. Until lately the Taiwanese producers relied only on ‘natural’ species which could be produced on

most Asian countries, hence not a source of long-term competitiveness. Now they are experimenting with non-natural varieties which display particular aesthetic features and longer durability (e.g. like the blue orchid) (Bradsher, 2004). The adoption of this strategy is clearly government led. SMEs in the cluster could not finance research activities nor did the Taiwanese producers initially considering investing in biotech as they did not realize the potential for upgrading of this strategy.

The government supports this upgrading strategy by heavily investing in building a very qualified workforce (in this particular case in biotech) and by providing the funding required for building the research infrastructure, such as the construction of greenhouse facilities explicitly targeting groups of SMEs. However, realizing the full potential of this upgrading strategy is contingent to establishing the right links between the producers, the researchers and the final markets (through the marketing channels) as we will discuss next.

Although the required organizational set-up is there, the strategy seems to have some difficulties in its implementation. One of the possible explanations is the lack of interactive learning and collaboration between the biotech-labs, the growers and the marketing coops^{ix}.

Building blocks of interactive learning: human capital and social capital in the cluster: Interactive learning between the bio-tech institutes and the marketing cooperatives is needed to develop new species that can be commercialized successfully in the global market. Furthermore, bio-tech institutes need to engage in interactive learning with the producers to ensure that the new flowers can be nursed by the farmers. However, currently collective action is frequent but limited to one activity of the value chain (as Figure 2 shows) and hence appears fragmented.

General competences are crucial for the upgrading process which places high demands for general skills on the growers and the knowledge providers (biotech) as the innovation strategy chosen in the cluster) requires a great absorptive capacity by the indigenous SMEs. In this sense, Taiwan has a privileged situation as for example 88,5% of the population has higher education. But social capital is weak and thus interactive learning limited.

In the cluster there is a clear division of labor between three groups of actors: the researchers (bio-tech institutes), the growers (family-based farms) and the distributors (whole sale companies). Social capital and interaction *within* each of the groups is high. Small businesses form tight networks encompassing personal and business relationships. These networks, *guanxi*, are based on traditional Chinese social values where human relationships are closely linked to families, relatives, friends, classmates, and previous colleagues (Liu, 1998) but partly segmented along ‘ethnic’ lines (e.g. Hakka, Mainlander and Taiwanese). However, the interactions *between* the three groups of actors (producers, distributors or researchers) appear to be weak^x which seriously questions the potential success of the upgrading strategy adopted.

3.3. Complex product systems (CoPS) - Thailand’s Automobile clusters

The Thai automobile industry – occasionally referred to as the Detroit of Asia – is considered to be the most important hub for automotive production in Asia (Lecler, 2002; Takahashi and Techakanont, 2002) and has until recently – at least – been considered a successful case^{xi}. Thai automotive clusters are TNCs-centred. Most major assemblers are present in Thailand^{xii}. Around 113,000 are employed in the industry where SME accounts for approximately 50% of the employees (Chiasakul, 2004). The indigenous Thai firms

are mainly SMEs that act as second and third tier subcontractors, mainly manufacturing auto-parts. The first tier consists of more than 700 companies where 40% of these are owned by TNCs. Second tier suppliers are around 1000 (Chiasakul, 2004). The Thai automobile clusters are important to the Thai economic and increasingly so. According to the latest WTO statistics (2005) the automobile industry grew from 3,5% of the value of the total economy in 2000 to 5,9 in 2004 (based on export measures). The export value has also grown over the same period. In 1990 the value of the export amounted to only US\$ 108 millions while ten years later it had grown to US\$ 2401 millions. Since then it has grown exponentially (from US\$ 2977 millions in 2002 to US\$ 5713 millions in 2004 (WTO 2005). Figure 3 plots the automobile value chain and the main actors in the cluster

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The role of the SMEs in the clusters has been greatly affected by the national policy which changed significantly after the WTO/GATT agreement. Until recently the Thai SMEs played a significant role as first or second tier subcontractors for the TNCs. Formal policies from the Thai central government stipulated that TNCs locating in Thailand had to guarantee a certain local content in the production. TNC were obliged to link up with local manufacturers. However, in the last years have the Thai SMEs have either been reduced to third or forth tier subcontractors, been bought up or gone bankrupt.^{xiii}.

Upgrading and interactive learning: In this context, it is possible to distinguish between two types of SMEs and upgrading opportunities: Foreign and joint-venture firms (1st tier suppliers) seem to have preferential access to the required technology and resources through their parent companies, that is, interactive learning takes place between the assemblers and the first tier suppliers, which happen to be, in the majority of the

cases, subsidiaries or joint-venture firms. Only these SMEs receive advice about quality control, maintenance and design drawings (for example to make dies or tooling) and advice about project management from the assemblers (Techakanont and Terdudomtham, 2004). For the vast majority of SMEs in the sector, interactive learning is very limited (Techakanont, 2003); incremental innovation is only the result of in-house efforts and the improved experience of employees – learning by doing – (Techakanont and Terdudomtham, 2004).

Role of human capital and social capital supporting interactive learning and upgrading: Thai firms did not use the advantage that they enjoyed during the “local content requirement” period to develop their human capital or implement organizational forms supporting product or process upgrading. They simply produced parts according to already established production methods, blueprints and – often – based on technology acquired from the TNC (Techakanont and Takahashi, 2004). As a result, most Thai SMEs lack the human capital and organisational ability required to engage in upgrading.

Furthermore, the acquisition of these competences through the interaction with other firms in the cluster is also very limited. In the Thai automobile clusters interactive learning is limited to first tier suppliers whilst second third-tier suppliers do not connect to the network as they do not meet the quality standards (Sevilla and Soonthornthada, 2000)^{xiv}. That is, collaboration based on social capital *between* Thai SMEs is not yet of much relevancy as most Thai SMEs simply do not have the competencies, knowledge and information that can create synergetic relationships.

As the situation is now Thai SMEs have to rely on knowledge acquired through interactive learning with the TNCs. This however is a challenging strategy with few successes (Vang and Asheim, 2006; Lall and Narula, 2004; Narula and Marin, 2005). The lack of human capital as well as the motivation to acquire the required technological

(engineering) capabilities prevents Thai SMEs to engage in interactive learning both with the TNCs and the SMEs, seriously hampering their ability to upgrade.

3.4. Specialized suppliers - Bangalore Software cluster

Bangalore has become one of the most important software clusters outside the OECD world to the extent that it is known as “India’s Silicon Valley” (Parthasarathy, 2004b; Saxenian, 2001). Bangalore is the center for advanced science and military research – this was mainly for physical geographical reasons such as clean air which was needed for military testing. For this reason, Bangalore houses several high-tech clusters (defense, aeronautics and IT) and is considered to be the scientific and engineering centre of India in terms of research, training and manufacturing. India’s best research university - Indian Institute of Technology - is based in Bangalore (Arora et al. 2001; Vang and Chaminade, forthcoming 2006). During the nineties, the easy access to qualified and relatively cheap technical human capital attracted a number of transnational corporations. Large firms such as IBM, Motorola, Hewlett-Packard, Siemens, 3M, Texas, etc. located in the area. Despite the weight of the TNC in the Bangalore IT sector, the large majority of firms are SMEs but only 10-15 % of the revenues of the sector are from them (NASSCOM, 2005).

The development of this particular city-region is more shaped by the industrial development in the US than local interactive learning or other cluster-effects (Vang and Asheim, 2006) and regional government bodies’ policies (van Dijk, 2003; Parthasarathy, 2004a). Though it should be stressed that Bangalore's growth until the late 1980s (when the software export boom began) relied on local (largely public sector) investments; Bangalore already had a dense organizational setting. The central government even

located the public telephone company in Bangalore as well as other large high-tech state enterprises.

Upgrading and interactive learning: The dynamics of the IT cluster in Bangalore are dominated by large TNCs located there. It is possible to find two types of SMEs: those tied to a TNC through a subcontracting agreement and a limited number of independent SMEs. As subcontractors, SMEs are responsible for the low-added value activities of the value chain, as Figure 4 shows (Arora and Gambardella, 2004). Frequently, SMEs undertake specific tasks for the large client firm who settles the parameters of the production and the final outcome and tightly controls the performance of the SME. For these SMEs, which are the majority, upgrading is defined by the large firms (Nadvi, 1995, Vang and Overby, forthcoming 2006).

Competence building in the indigenous SMEs has run in parallel to their role as subcontractors of TNCs, mainly located in the US (Parthasarathy and Aoyama, forthcoming; Vang and Chaminade, 2006). Several studies have documented that during the first phase US-firms mainly outsourced routine IT-services to India (such as maintenance of existing code or translating one code from one programming language to another). However, this form of interactive learning was enough for some firms to acquire skills on project management, timely delivery, organization of production according to US standards and so forth that allow them to start moving up the global value chain. There is emerging evidence on the move from low cost providers to knowledge providers in certain segments of the software industry, notably embedded software (Parthasarathy and Aoyama, forthcoming). The analysis of this specific and advanced case, points to the importance of engaging in interactive learning not only with TNCs but also with other indigenous SMEs.

- INSERT FIGURE 4 HERE -

With the exceptions of these advance firms, especially in embedded software segment (Parthasarathy and Aoyama, forthcoming) learning through the interaction with other indigenous SMEs is quite limited. Interaction takes place fundamentally between the indigenous firms, on the one hand and the TNC on the other. This interactive learning is possible, among other factors, because of the high qualification of the human resources available in the cluster.

Role of human capital and social capital supporting upgrading and interactive learning: Accessing qualified workers is not a problem for the SMEs of this cluster and, in this sense, their capacity to absorb knowledge and technology generated outside the SME (absorptive capacity) is very high. There are several universities, business schools and technical schools located in the region that provide the cluster with the required supply of technically qualified labor.

With the exception of the embedded software, collaboration between SMEs based on social networks is limited in the IT cluster, but it exists. Interpersonal networks are based on common schooling and alumni links built around the many technical schools located in Bangalore as well as on previous working relationships (people that have previously been working together in the same firm). Consortia of SMEs have often been prone to failure due to the competitive tendencies among group members. Evidence suggests that they have been more effective when member firms are complementing each other and not competing. Joint action has often involved marketing of products and seldom the development of a product with the exception of the embedded software (Parthasarathy and Aoyama, forthcoming; Vang and Chaminade, 2006).

But social capital transcends the regional boundaries in this cluster. The social capital of the Indian transnational community played a crucial role in establishing the IT

industry (Vang and Overby, forthcoming 2006). To get access to orders, capital and more sophisticated knowledge the Indian firms were forced to target transnational corporations. This uncertainty allowed the Indian transnational community, who held important positions in the US firms, to play a significant role in shaping the outsourcing decisions in the US firms

In sum, despite there is increasing evidence that suggests that some Bangalore firms have developed a certain degree of autonomy from the lead firms in US and Europe that has allowed them to move up the global value chain, most firms operate in the low-end of the value chain^{xv}. The autonomy is a function of investments in human capital and new managerial strategies; hence they can now provide all types of services from the highest end of the value chain to the bottom end. Part of the successful transformation process has been facilitated by increased cluster-effect and spin offs from the different universities located in Bangalore. However, the Indian firms did only to a limited extent engage in interactive learning compared to Silicon Valley and other similar clusters.

4. Innovation Policy for SMEs – learning from the cases

This section aims at drawing lessons for the design and implementation of cluster policies to support upgrading in Asian SMEs. The lessons are based on the cases; hence we do not suggest they can be automatically applied to other clusters. Instead they serve purpose of illustrating the need for a diversity of actions to support different learning and upgrading trajectories. We critically use the cluster framework to discuss how the government selectively can invest in the weak and critical nodes of the cluster to support interactive learning in the cluster by enhancing SMEs innovative capabilities (i.e. move

from knowledge users to knowledge providers) and facilitating networking and social interaction for this purpose.

In this paper we argue that when designing innovation policy for SMEs, policy makers need to take into account the different industry specificities and position in the global value chain of the clustered SMEs. The cases illustrate that interaction will not lead to upgrading unless it is accompanied by investments in human capital and social capital. They also demonstrate that clustering does not automatically lead to interactive learning as pre-conditions in terms of human capital, knowledge provision and social capital exist. Notably, the firms need to have absorptive capacity and be engaged in networks that facilitate knowledge exchange. Policy makers might intervene when these two pre-conditions are not in place, that is, when systemic failures (Chaminade and Edquist, 2006a and b) occur.

Applying the cluster approach has proven useful as the point of departure for the design of innovation policies to support SMEs upgrading. In contrast to other more atomistic approaches working with the same variables but in isolation, the cluster approach considers the links and dependencies of the different institutions and organizations. Thinking “systemic” allows selective interventions in the weakest nodes in the system and/or on the most critical nodes. Selectivity is crucial for developing countries where financial resources are extremely scarce.

Industry and institutional contingencies dictate what are the areas in which a governmental intervention is most needed in the cluster e.g. investments in the interaction between TNCs and SMEs, or between SMEs, or the supply of human capital and so forth.

In traditional industries as illustrated by the Jepara furniture cluster in Indonesia the major weakness for the SMEs in the cluster is upgrading the local craftsmanship to meet

international demands. Social capital exists but the low qualification of the human resources impedes the SMEs to engage in interactive learning, therefore benefiting from dynamic clustering advantages. This can be solved partly if local manufacturers can link up to international buyers and international markets directly. For SMEs not possessing the skills needed for harvesting the benefits from collaborating directly or indirectly with international buyers the government could provide information on international demands, standards and international markets and facilitate the access to international markets. However, providing information is only one variable in the equation. SMEs also need to change their productive competences according to the demands of the global markets. Regional governments can facilitate the acquisition of new competences through training tailored to the specificities of the local industry and the global markets.

In the resource-based industry represented by the Taiwan flower industry the weakest node constraining SMEs innovative performance is the lack of competencies allowing SMEs to move up in the global value chain. Success stories like the wine and salmon production in Chile or the Taiwan case in our paper show that this can be attained by linking the industry to biotechnology research. Central in the policy interventions is the collaboration between the knowledge providers (universities and research institutions) and the producers as well as the provision of hard scientific infrastructure and qualified human capital. Local producers can then enter international market with a knowledge intensive new product, creating a new niche market. The government has a crucial role to play as this strategy requires significant investments in research facilities that exceed SMEs capacity. But hard infrastructure is only one part of the system. The linkages between the knowledge infrastructure (biotech labs for example), the producers and the markets need to be in place and SMEs need to have the knowledge to understand the possibilities of the new products (absorptive capacity).

The policies in CoPS, like the Thai automotive clusters illustrate, are highly dependent on the TNCs willingness to provide assistance on technological upgrading and building of design competencies as this is beyond the scope of the indigenous SMEs. When TNCs provide this type of information/assistance it is mainly to first tier suppliers. SMEs do not play a significant role as first tier suppliers as most indigenous SMEs do not comply with the international quality standards required by the TNC. The cases illustrate that at least two strategies are possible. One is to regulate the relationship between the TNC and the SME, for example, forcing the TNC to subcontract with indigenous SMEs. While this might seem a viable solution in the short term, it does not provide the right incentives for the SMEs to acquire new competences, as the Thai case shows. The second strategy is for the government to focus directly on improving the competences of the indigenous SMEs. This calls for government intervention focusing on providing the needed industry specific technical and managerial training and the development of indigenous technologies.

Finally the policies targeting specialized suppliers as illustrated by the Bangalore case initially consists in building the required human capital level engage in cost-based collaboration with TNCs. Once that this level is attained the largest problem that the SMEs in these types of industries in Asia are currently facing is getting the high-value assignments that would allow them position in higher parts of the value chain. While the SMEs might have the formally needed competencies for undertaking these activities, TNCs do know or do not trust yet the ability of the indigenous SMEs to undertake these activities. This prevents them from transforming their formal competencies into 'real' competencies; this transformation requires user-producer interaction. This problem is central as the SMEs cannot rely on localized lead users. In parallel knowledge tend not to be distributed within the clusters of co-located firms. Thus after initial phases with

investments in human capital public interventions should focus on public procurements allowing where the public government bodies functions as lead users (lead users demanding local interaction).

Conclusions and further research

This paper has contributed to the current discussion on the link between interactive learning and upgrading in clusters linked to global value chains in different ways. The paper provides an analytical framework to study interactive learning in clustered SMEs that stresses the systemic propensities of the interactive learning in clusters. The relevance of the framework is illustrated by applying it to the four most common clusters of SMEs in Asia, being resource-based industries, traditional industries, complex production systems and specialized suppliers. The analysis critically reviews the general assumption that clusters facilitate interactive learning and upgrading. The cases inductively allude to the diversity of types of interactive learning that exist, qualifying when they are relevant and which conditions that underpin their efficient use. Additional research is needed to identify critical learning and unlearning paths in each of the industries as well as their evolution over time. In addition, the paper contributes to the cluster literature by paying explicit attention to the transformation of SMEs from knowledge users to knowledge creators which has tended to be ignored in the dominant literature, underpinning the observed industry differences. The paper also attempts to translate these insights into relevant policy measures that takes the identified specificities into account and also concludes on the division of decision-making structures.

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ⁱ Malmberg (2003) proposes to clearly distinguish between industrial cluster and regional cluster. From our point of view, such distinction, although valid from a theoretical point of view has limited use in practical terms as cluster refers both to industrial and spatial agglomerations.

ⁱⁱ Despite its critics (Benneworth and Henry, 2004; Sunley and Martin, 2003) the cluster concept is a useful *heuristic device* for identifying geographical concentrations of industrial activities and analyzing the consequences of clustering for (mostly incremental) innovation and economic development in developing countries (Bair and Gereffi, 2001; Chaminade and Vang, forthcoming 2006; Giuliani et al, 2005a and b; Pietrobelli and Rabellotti, 2004)

ⁱⁱⁱ As a proxy for the lack of general human capital one can use illiteracy-rates. And adult illiteracy still reaches the two digits in some countries such as Indonesia and Malaysia (World Bank, 2003). Enrolment in secondary education is around 50%

^{iv} The human capital literature has not paid sufficient attention to knowledge provision not explicitly linked to formal education (i.e. the provision of knowledge products from research labs, technical institutes, etc) despite the documented importance these knowledge providers in the development of firms (Chaminade and Vang, forthcoming 2006; Laursen and Salter 2004). Knowledge providers can be directly involved in developing relevant technologies for the firms (applied technological knowledge), generating new ideas and products, and even providing technical training. In the context of developing countries knowledge providers can thus be engaged in knowledge creating activities targeting the industry and/or SMEs needs with the aim of reducing their dependency on TNCs as the sole sources of knowledge and technology.

^v Contrary to envisioned by standard economists economic interaction is not primarily a market-based exchange of (tangible) goods by anonymous agents regulated by a complete contract (in the context of efficient contract enforcement) but the exchange relies on incomplete contracts either due to the lack of possibilities for creating complete contracts, because of the disadvantages in terms of a low degree of flexibility built into complete contracts, or because of inefficient contract enforcement, depending on the mutual trust of the partners involved in the transaction. This is especially the case for innovative activities and/or activities drawing on tacit knowledge.

^{vi} Traditional manufacturing and natural resources-based industries are the most numerous in most Asian countries (Dhungana 2003). Food and beverages and Textiles are the most important industries in terms of employment and added value in manufacturing at least in India, Indonesia, Philippines, China, Sri Lanka and Thailand. They are also characterised by high degree of geographical concentration. Only some of the most advanced economies of the region (Korea and Singapore) are not strongly dependent on these two industries. The economic weight of the traditional manufacturing and natural-resource based industries in the area justify a deeper analysis of the innovation patterns in these two types of industries, mainly dominated by SMEs. For the most advanced countries in the region such as Singapore, Korea, Hong Kong, Singapore, Malaysia and (some parts of) India the picture is somewhat different with a clearer dominance of specialized suppliers (such as IT manufacturers or software suppliers) and in the case of Thailand or Korea, the production of motor vehicles.

^{vii} The Taiwanese government has settled the priorities for the economic development of the island, being one of them the biotech sector and its connections with other local industries including the floral industry.

^{viii} This is a very new strategy whose results are yet to be seen. The analysis that follows tries to assess the potential success of this strategy, taking into account the existing linkages between the different actors at stake. In order words, we try to assess the potential for interactive learning in the cluster giving the current availability of human and social capital.

^{ix} Personal communication with a representative of the Taiwan Institute of Economic Research. Name kept secret for confidentiality reasons.

^x This has been confirmed by some interviews with local experts.

^{xi} The Thai automobile industry is a clear example of a satellite cluster. Initially the production was located close to Bangkok. Diseconomies of agglomeration (ranging from increased wages, scarcity of workers to

traffic congestion) resulted in the emergence of new clusters scattered around Thailand where Chonburi, Bangkok, Rayong, Samutprakarn and Pathumthani are among the most important ones (for details on the differences in their internal specialization, see Chiasakul 2004).

^{xii} From Japan: Toyota, Honda, Isuzu, Nissan, Mitsubishi, Hino; US: GM, Chrysler, Ford; Europe: BMW, Volvo, Daimler, Volkswagen, Citron, and Peugeot).

^{xiii} This can be attributed to the general ‘deregulation’ enforced by WTO/GATT. The Thai government interpreted the WTO/GATT agreement as entailing the dismantlement of the “local content requirement” and a general opening of the economy to FDI. As a result TNC subsidiaries established production in the Thai clusters and out competed the Thai SMEs.

^{xiv} As an example, only 10 % of the Thai suppliers have ISO 9000, 14000 or 18000.

^{xv} This can be documented with fact that value pr. employee in India is only a forth of that of the US and only slightly above China’s and Brazils (Arora and Gambardella, 2004).